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EXAMINER

MCCRACKEN, DANIEL

ART UNIT	PAPER NUMBER
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1793

NOTIFICATION DATE	DELIVERY MODE
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ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No. 10/521,453	Applicant(s) MARUYAMA ET AL.	
	Examiner DANIEL C. MCCracken	Art Unit 1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 August 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 14-23 and 25-36 is/are pending in the application.
- 4a) Of the above claim(s) 25, 34 and 36 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 14-23, 26-33 and 35 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claim(s) 14-23 and 25-36 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Citation to the Specification will be in the following format: (S. # : ¶/L) where # denotes the page number and ¶/L denotes the paragraph number or line number. Citation to patent literature will be in the form (Inventor # : LL) where # is the column number and LL is the line number. Citation to the pre-grant publication literature will be in the following format (Inventor # : ¶) where # denotes the page number and ¶ denotes the paragraph number.

Response to ArgumentsElection/Restriction

Applicants traverse the restriction requirement in the Final Office Action dated 5/28/2008 on the basis that PCT Rule 13 precludes a holding of lack of unity for the claims as now presented. This is not persuasive for any number of reasons: At the outset this is a national stage case, *not* a PCT filing in the “Chapter I” phase before the international search authority. As such, Applicants reliance on PCT Rule 13 is inapposite. In the United States, Title 37 of the Code of Federal Regulations (in addition to Title 35 of the U.S. Code) is applied. The Examiner presumes that Applicants meant to cite US law, as of course, Applicants are seeking a United States patent and this is the United States Patent and Trademark Office.

Unity of invention in the US national stage is set forth in 37 C.F.R. §1.475 which recites, *inter alia*:

- (b) An international or a national stage application containing claims to different categories of invention will be considered to have unity of invention if the claims are drawn only to one of the following combinations of categories:

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- (4) A process and an apparatus or means specifically designed for carrying out the said process; or

Presumably, this is the provision Applicants meant to cite. On its face, Applicants arguments in light of this authority must fail, unless the Examiner were to totally ignore the claims and prior art. Note that the rule states “apparatus or means *specifically designed for carrying out the said process.*” 37 C.F.R. 1.475(b)(4) (emphasis added). Claims 34, 36 and 25 are so broadly drawn that they read on a parts catalog from a chemical lab supply company. Note that there is absolutely no connectivity between the various structural features in the claims, and the remainder of the claim language recites statements of intended use, which are not given patentable weight in the United States. Stated differently, the claimed apparatus is not specifically designed for carrying out the process. There is absolutely nothing in the claims or disclosure (insofar as the Examiner can determine) that would preclude this “collection of parts” from being used to refine gasoline, make specialty chemicals, polymers, carbon black and the like (in addition to serving as a boat anchor, etc.). All of those chemical processes involve “raw material gas-feeding parts[s],” etc. For this reason alone, Applicants traversal fails.

It should be noted – *and perhaps most importantly* - that Applicants traversal *totally ignores* the procedural posture that the claims are in and *totally ignores* the history of this case. This case entered the national stage on January 14, 2005. There were eleven original claims pending – all drawn to a process. Applicants filed a preliminary amendment on January 14, 2005 cancelling all eleven claims and writing 21 new claims (which bore a striking resemblance to the originally filed claims) – all drawn to a process. Presumably, this was done to correct multiple dependency issues, but also to add limitations/features not claimed before the international

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search authority. At this time (January 14, 2005), Applicants could have written apparatus claims, product claims, composition claims, etc. if they wanted to. *But they didn't.* They wrote method claims. This case was not taken up by the Examiner until October 22, 2007. Thus, Applicants had over two and a half years to reflect on the claims they had filed, add additional claims drawn to different statutory classes, add new dependent claims, etc. *But they didn't.* Applicants wrote method claims and were apparently (insofar as the Examiner can determine) perfectly happy with their method claims . . . until the Examiner rejected them.

In the Non-Final Office Action dated 10/22/2007, Claims 12 and 13 (among others, and *as filed* by way of preliminary amendment on January 14, 2005) were rejected under 35 U.S.C. 112, second paragraph under any number of theories, but succinctly stated: the claims made no sense whatsoever. As noted above, the claims were drawn to a method but the claims recited a host of parts that were totally unconnected from any process or method step. They were indefinite, and were rejected as such.

In Applicants response dated February 22, 2008, Applicants cancelled the offending claims (Claims 12-13) and drafted two entirely new claims drawn to an apparatus, Claims 34 and 36. Claim 25 – which up until this point in time was a process claim – was all of the sudden made to depend from Claim 36, an apparatus claim. Thus, Applicants added claims to a different invention from a different statutory class (an apparatus or a machine) after an office action. *At no point in time prior to February 22, 2008 had Applicants been pursuing apparatus claims.* MPEP 821.03 states:

Claims added by amendment following action by the examiner, MPEP § 818.01, §818.02(a), to an invention other than previously claimed, should be treated as indicated by 37 CFR 1.145.

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37 CFR 1.145. Subsequent presentation of claims for different invention.

If, after an office action on an application, the applicant presents claims directed to an invention distinct from and independent of the invention previously claimed, the applicant will be required to restrict the claims to the invention previously claimed if the amendment is entered, subject to reconsideration and review as provided in §§ 1.143 and 1.144.

This is why Applicants newly presented claims drawn to a different invention were restricted. They were never presented in the first instance as suggested by the PCT rules and are independent and distinct for any number of reasons as noted in prior office actions. Applicants are effectively trying to "cut in line" in front of the hundreds of thousands of other pending cases at the USPTO to present another invention after their originally filed invention was rejected. This is the practice that MPEP 821.03 seeks to prohibit.

The Examiner respectfully submits that the provision of the PCT that Applicants try to rely on (Rule 13 – which as noted above is really directed to the Chapter I search) and the corresponding regulations in the United States (37 C.F.R. 1.475 *et seq.*) seek to encourage thoughtful, careful claim drafting *for claims as originally filed*. Stated differently, if a hypothetical inventor invented a new process and a new apparatus for carrying out that process, claims to these two inventions could be drafted, then filed in an international search authority and be searched without a holding of lack of unity. The rules do not promote the practice where Applicants can draft claims, enter a national stage, “strike out” on substantive grounds (35 U.S.C. §§101-103, 112), then abandon those claims in favor of a totally different invention drawn to a totally different statutory class. This is exactly what has happened here. This practice reflects careless claim drafting, translation, or both and is extremely burdensome on the Examiner. Note also that the rules surrounding restriction/lack-of-unity do not exist for the sole

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purpose of allowing applicants to jam as many claims to as many statutory classes in a case; they also exist to keep claims in front of the examiner best suited to examine them.

Before any procedural burden is placed on the Examiner, there is the initial burden of claiming the invention that falls on the Applicants. *See e.g.* 35 U.S.C. 112, second paragraph (“The specification shall conclude with one or more claims particularly pointing out and distinctly claiming *the subject matter which the applicant regards as his invention.*” (emphasis added) *and* EPC Article 84 (“*The claims shall define the matter for which protection is sought. They shall be clear and concise and be supported by the description.*”) (emphasis added). Japan probably has a similar provision, but the Examiner does not read Japanese. The Examiner submits that this burden was not met. It is *not* the Examiner’s job to review a collection of poorly translated words and compare this against the arguably infinite universe of prior art (*see* 35 U.S.C. 102) and arrive at his own subjective determination of what the “invention” is. Rather, Applicants tell the Examiner what they believe they have invented, and the Examiner searches the prior art to determine what they are entitled to. Applicants remarks seem to reflect a belief that somehow, the Examiner was to “read the Applicants mind” (i.e. disregard 35 U.S.C. 112, second paragraph) and somehow determine that they really meant to draft claims to a reactor (*and pay for them*, which they didn’t). This is not how the process works. How the Examiner was supposed to discern from the entire file history that Applicants meant to present apparatus claims is beyond him, especially when there are two layers of patent attorneys (US and Japanese) between him and whatever process may or may not have been invented that (1) draft claims and (2) ensure that what they drafted is what the client wants. Claiming is the Applicants’ job – not

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the Examiner's. The Examiner will not graft Applicants claims into this *ex post facto*. It was their responsibility to present them up front.

Insofar as the Examiner is aware, there is no rule directed to this exact situation for national stage entries from a PCT filing, namely the situation outlined above where Applicants can present different statutory classes after receiving a first action on the merits rejecting their original claims. Should Applicants representative, Naphtali Matlis have any authority to the contrary, he is expected to bring it to the attention of the Examiner. The Examiner is of the opinion that the procedure as set forth in MPEP 821.03 is the proper procedure to be applied here. Furthermore, Applicants and their representative should note that just because they have filed a PCT, that doesn't preclude finding a lack of unity in the national stage. *See* 37 C.F.R. §1.499. For at least those reasons noted above (i.e. the apparatus claims are not specifically designed for carrying out the process), the restriction is proper.

Accordingly, and because Applicants have presented apparatus claims not specifically designed for carrying out the process after receiving a first action on the merits, the restriction requirement is proper and FINAL. Continued traversal of the restriction should address how Applicants can present claims drawn to different statutory class *after* receiving an office action. Failure to do so will result in Applicants reply being held non-responsive. Filing an RCE does not permit a shift of the elected invention.

Claim Rejections 35 USC §§ 102-103,112

Applicants have amended all claims to recite features not present in the claims that formed the basis for the rejection. The claims define the invention. 35 U.S.C. 112, second

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paragraph. As the claims are now directed to a different invention, all rejections are mooted by amendment and WITHDRAWN. New rejections appear forthwith.

The Examiner hereby requests the IUPAC Compendium of Chemical Terminology referenced by Applicants at page 12 of their remarks be submitted, as he considers it material to patentability. Applicants conflate “axial” and “chiral” in their remarks and dismiss the rejection instead of seeking to resolve the issues. These issues are elaborated on in the rejections *infra*. The cooling/recycling issue argued, as it pertains to the amendments made, is addressed in the rejections below.

Drawings

Figure 5 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled “Replacement Sheet” in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

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Claims 14-23, 26-33 and 35 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Review of the Specification shows that it does not support the amendments to all claims. Specifically, it is unclear where “separating the fiber from the catalyst, creation of a reacted reaction gas,” and recycling the cooled and second-cooled reacted gas as claimed in the dependent claims. Applicants have not indicated where they are drawing their support. The Examiner has twice requested Applicants to do so in their responses, and these requests continue to be ignored by Applicants and their counsel. It is not clear whether Applicants are drawing support from their marked up copy of the specification or their originally filed specification. To the extent the Examiner has overlooked the portion relied upon, Applicants are requested to indicate this in their response.

The Specification lacks any of the details that would convey to one ordinary skill in the art that Applicants had possession of an “*axial* chiral fine carbon fiber,” whatever that is. Such details would presumably include micrographs. For example, see Lau, et al., *The revolutionary creation of new advanced materials - carbon nanotube composites*, Composites: Part B 2002; 33: 263-277. (note “Fig 9 on p. 268, showing one of the chiralities captured by a microscope). Applicants have not provided any detail to indicate they had possession of any nanotube, let alone an “axial chiral fine carbon fiber.”

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Claims 14-23, 26-33 and 35 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

The analysis for determining whether a claim is supported by the disclosure is cast in terms of whether “undue experimentation” is necessary to practice the invention. *See* MPEP 2164.01. In examining the claims in light of the supporting disclosure, the Federal Circuit has provided a non-exclusive list of factors to consider in determining whether a disclosure is enabling. *See generally In re Wands*, 858 F.2d 731, 737, 8 USPQ2d 1400, 1404 (Fed. Cir. 1988).

These factors include:

- a. The breadth of the claims;
- b. The nature of the invention;
- c. The state of the prior art;
- d. The level of one of ordinary skill;
- e. The level of predictability in the art;
- f. The amount of direction provided by the inventor;
- g. The existence of working examples; and
- h. The quantity of experimentation needed to make or use the invention based on the content of the disclosure

Id. “Whether undue experimentation is needed is not a single, simple factual determination, but rather is a conclusion reached by weighing many factual considerations.” *Id.* Examiner has considered all factors in light of all claims rejected makes the following findings of fact:

a. The breadth of the claims

Claims 33 and 35 are the independent claims. *If* the claims have support in the disclosure, they allegedly claim a process wherein carbon nanotubes (or in the Japanese parlance “fine

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carbon fibers”) are produced via thermal decomposition of hydrocarbons. The claims broadly recite various “parts” that form various functions.

Claims 27-32 further narrow Claims 33 and 35 to claim various diameters as well as a one specific chirality or type of nanotube, namely one with an “axial chiral” structure. Claims 27 and 28 recite very narrow nanotubes.

b. The nature of the invention

The invention is allegedly a process for making “fine carbon fibers” from oxygen containing hydrocarbons.

c. The state of the prior art and the level of one of ordinary skill

The level of skill in the art is typically high (e.g. PhD level chemists). The prior art is fairly well developed, but wide-spread owing to the applicability of nanotubes in a variety of fields.

d. The level of predictability in the art

This is an unpredictable art. For example, see Kim, et al., *Synthesis of Ultralong and High Percentage of Semiconducting Single-walled Carbon Nanotubes*, Nano Letters 2002; 2(7): 703-708. Note the passage at page 706, col. 2 which is reproduced below:

It is therefore concluded that our CVD growth conditions in fact produce SWNTs with no preference in chirality (Table 1). ***This result is not surprising considering the high growth temperature that can smear out the differences in thermodynamic energetics and kinetics for the growth of various chirality nanotubes.*** The initial nanotube nucleation process appears to be a determining step for tube chirality, after which the same chirality tends to be retained during nanotube lengthening in the base growth^{1,2} mode.

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An important task then is to elucidate how various factors during nucleation determine the nanotube chirality by experiments and theory. These factors include growth temperature and structures of the nanoparticle seeds (diameter, shape, etc.). The interfacial structure between the nanoparticle and its supporting substrate could also play an important role. *Understanding and controlling these factors will be indispensable to controlling nanotube chirality.*

(Kim at 706) (emphasis added). Clearly, controlling chirality is not without its difficulties. Likewise, making the small diameters claimed is not without its challenges. The Examiner's understanding of the prior art indicates that this is only possible with an arc-discharge process. For example, see Qin, et al., *The smallest carbon nanotube*, Nature 2000; 408: 50-51. Note especially col. 3 ("It remains a challenge to produce single-walled carbon nanotubes of 4Å diameter experimentally.").

e. The amount of direction provided by the inventor

Insofar as the Examiner could understand the disclosure, scant guidance was provided. Noteworthy was the lack of discussion of the factors discussed by Kim, et al. insofar as they relate to chirality.

f. The existence of working examples

Several working examples were allegedly presented, but these do not detail the sizes or chiralities claimed.

g. The quantity of experimentation needed to make or use the invention based on the content of the disclosure

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Given the unpredictable nature of the art (*see* Kim) and the lack of guidance presented, arguably infinite and certainly undue experimentation is needed to practice the claimed invention.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 14-23, 26-33 and 35 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

With respect to Claims 33 and 35, it is not clear what reaction Applicants are trying to describe. Presumably the reacted gas forms the “fine carbon fiber.” Are Applicants claiming another reaction? This ambiguity precludes a targeted search, is it is not clear what is reacted, what is cooled, etc. With respect to Claims 27, 30 and 32 as well as Claims 28, 29 and 31, Applicants claim “fine carbon fibers” with a diameter between 0.1 nm and 1 nm (Claims 27 and 28). The dependent claims then broaden this range out (*i.e.* failure to limit) to 5 nm or less and 10 nm or less. How is this possible? Ranges within ranges, especially when one range is not within the other, are *prima facie* indefinite. With respect to Claims 29-32, “axial chiral” is indefinite. Applicants should submit the IUPAC Compendium. The Examiners initial comments in the Final Office action are correct in that all types of nanotubes are referred to as “chiralities” in the art. If Applicants are referring to one over the other (*i.e.* “chiral” over “zig-zag”), that is fine, but it says nothing of “axial” which modifies “chiral.” What is this? Applicants are expected to fully respond and develop this issue in their response. A failure to will result in the response

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being held non-responsive. The Examiner reserves all rights to make additional rejections under 35 USC §§101-103, 112 as appropriate in light of their response. All other claims import the defects of the claims they depend from.

Claim Rejections - 35 USC § 102

Claims 14-23, 26-33, and 35 rejected under 35 U.S.C. 102(e) as being anticipated by US 6,919,064 to Resasco in view of Dresselhaus, et al., *Science of fullerenes and carbon nanotubes* 756-776 (Academic Press 1996) (hereinafter “Dresselhaus at ___”) to show a state of fact.¹

With respect to Claim 33, Resasco discloses a method for making carbon nanotubes wherein an oxygen containing organic compound (i.e. "an IUPAC group 16 periodic table element") is thermally decomposed with the aid of a transition metal catalyst. *See e.g.* (Resasco 6: 50-56) (thermal decomposition), (Resasco 6: 63 – 7:64) (catalyst – note transition metals are taught at least at 7: 1-12), *and* (Resasco 7: 65—8: 10) (teaching alcohols and ketones). Resasco recites any number of collecting and separating steps, and the apparatuses for accomplishing them. *See e.g.* (Resasco “Figs 2-5,” 13: 35 *et seq.*) Other embodiments in Resasco may disclose collecting and separating, and Applicants are put on notice that the entire document is considered relevant. Note that Resasco teaches cooling. *See e.g.* (Resasco 9: 35-36). Finally, any number of recycle loops are taught. *See e.g.* (Resasco “Figs 2-5,” 13: 49-51) *and* (Resasco “Abstract”) (“The process also contemplates *processes and apparatus which recycle and reuse the gases and catalytic particulate materials, thereby maximizing cost efficiency, reducing wastes, reducing the need for additional raw materials, and producing the carbon nanotubes, especially SWNTs, in*

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greater quantities and for lower costs.") (emphasis added). As to Claim 16 and 20, Resasco discloses any number of conversions and yields in the Examples presented. *See e.g.* (Resasco 15: 55-58, 16: 1-11, 18: 67 - 19: 2, 19: 38-61, "Figs 6-10"). Thus, given that Resasco discloses recycle streams, it is necessarily expected that unconverted feed in the amount of 50% or more is recycled. This (the conversions and the presence of a recycle stream) is the evidence offered to show inherency. "[T]he PTO can require an applicant to prove that the prior art products do not necessarily or inherently possess the characteristics of his [or her] claimed product. Whether the rejection is based on inherency' under 35 U.S.C. 102, on prima facie obviousness' under 35 U.S.C. 103, jointly or alternatively, the burden of proof is the same...[footnote omitted]." The burden of proof is similar to that required with respect to product-by-process claims. *In re Fitzgerald*, 619 F.2d 67, 70, 205 USPQ 594, 596 (CCPA 1980) (quoting *In re Best*, 562 F.2d 1252, 1255, 195 USPQ 430, 433-34 (CCPA 1977)). Here, the "product" is the composition of gas in the Resasco recycle stream. As to Claims 27 and 30, note that Resasco discloses the production of "SWNTs" or "single walled nanotubes." *See e.g.* (Resasco 6: 23) ("production of SWNTs"). The claimed diameters for are expected to be taught. Likewise, and in light of the ambiguities associated with the term, it is expected that whatever "axial chiral" means, it is expected to be necessarily taught. Finally, with respect to Claim 32, note that while Resasco is directed in large part to single-walled nanotubes, it discloses "nanotubes" in both the generic (i.e. "nanotubes") and the specific (i.e. "SWNT"). *See e.g.* (Resasco 2: 53-60). Further, Resasco recognizes that which is well known in the art – namely any of the processes for making carbon nanotubes makes all different types: single-walled, multi-walled, etc. This principle is recognized

¹ Multiple reference 35 U.S.C. 102 rejections are proper when extra references are cited to explain the meaning of a

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at (Resasco 2: 31-34). Thus, Resasco necessarily discloses multi-walled nanotubes (i.e. there are two "kinds" of nanotubes; single-walled and multi-walled). The claimed diameters are expected to be taught.

With respect to Claim 35 and 14-15, to the extent that Claim 35 repeats limitations discussed previously, the preceding analysis is relied upon. It is expected that cooling chamber/gas at, *e.g.* (Resasco 9: 35-36) provides the cooling necessary to condense whatever gas is being claimed. Note that once a fluid is condensed, droplets running down the wall of a reactor can be construed as a "moisture separator." As to Claims 17-19, and 21-23, see discussion of recycle above. As to Claim 26, note the discussion of a porous material at *e.g.* (Resasco 9: 18 *et seq.*) As to Claims 28, 29 and 31 see discussion and references related to diameter, above.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action. The references cited teach each and every limitation of the rejected claims. The pinpoint citations are in no way to be construed as limitations of the teachings of the reference, but rather illustrative of particular instances where the teachings may be found. As to the rejection under 35 U.S.C. §§ 102/103, where the applicant claims a composition in terms of a function, property or characteristic and the composition of the prior art is the same as that of the claim but the function is not explicitly disclosed by the reference, the Examiner may make a

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rejection under both 35 U.S.C. 102 and 103, expressed as a 102/103 rejection. See MPEP 2112

III. (discussing 102/103 rejections).

Remarks

The Examiner takes official notice that “IUPAC group 16” containing organic compounds have long been used in nanotube synthesis. In support of taking official notice (*i.e.* in making sure there is substantial evidence on the record), the Examiner provides the following:

1. WO 00/17102 to Smalley, et al – see (Smalley 10: 20) (“oxygen containing hydrocarbons”).
2. US 6,919,064 to Resasco, et al – see (Resasco 7: 65 *et seq.*)
3. Maruyama, et al., *Low-temperature synthesis of high purity single-walled carbon nanotubes from alcohol*, Chemical Physics Letters 2002; 360: 229-234.

Using a known material consistent with its known uses is *prima facie* obvious. Given the high level of skill in the art, one of ordinary skill would recognize an oxygen containing substance as an obvious substitute for other hydrocarbons. To the extent any “motivation” is needed, it is taught by Maruyama at, *e.g.* p. 230, col. 1. Note the “high purity” and lower soot formation. For brevity’s sake, the Examiner will refer to this collection of documents as “Smalley, et al.” when official notice is taken herein.

Claims 14-23, 26-33, and 35 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over 6,919,064 to Resasco in view of Dresselhaus, et al., *Science of fullerenes and carbon nanotubes* 756-776 (Academic Press 1996).

The preceding discussion accompanying the anticipation rejection *supra* is expressly incorporated herein by reference. See above with respect to 102/103 rejections.

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Claims 14-23, 26-33, and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over 6,919,064 to Resasco in view of Dresselhaus, et al., *Science of fullerenes and carbon nanotubes* 756-776 (Academic Press 1996), US 6,761,870 to Smalley, et al., Choi, et al., *Controlling the diameter, growth rate, and density of vertically aligned carbon nanotubes synthesized by microwave plasma-enhanced chemical vapor deposition*, Applied Physics Letters 2000; 76(17): 2367-2369 (hereinafter “Choi at ___”) and Bower, et al., *Nucleation and growth of carbon nanotubes by microwave plasma chemical vapor deposition*, Applied Physics Letters 2000; 77(17): 2767-2769 (hereinafter “Bower at ___”).

The preceding discussion accompanying the anticipation rejection *supra* is expressly incorporated herein by reference. With respect to Claims 16-23, to the extent Resasco *may* not disclose recycle of the gases in the ratios claimed, Resasco does provide extensive kinetic data and relationships. *See e.g.* (Resasco 14: 55 *et seq.*, 4: 28-30, “Figs 6-10”). Recycling a stream - in addition to the advantages noted in the Abstract – affects the concentrations/partial pressures of components, which in turn affects the rates of reaction. Optimization of this does not impart patentability. *In re Boesch*, 205 USPQ 215, 219 (CCPA 1980). Furthermore, with respect to Claims 28-32, to the extent Resasco *may* not necessarily disclose the claimed diameter of the resulting nanotube, the diameter of the catalyst controls the diameter of the nanotube. To the extent Resasco may not teach this, the Examiner takes official notice that this parameter is old and known. In support of taking official notice (i.e. in making sure there is substantial evidence on the record), the Examiner cites to US 6,761,870 to Smalley, et al. at 8: 58 *et seq.*: “Generally, the diameter of the growing nanotube is proportional to the size of its active catalyst cluster at the time the tube starts to grow.” It should be noted that this parameter is well described in the

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non-patent literature as well. *See e.g.* (Choi at 2369) ("Thus, the diameter of a carbon nanotube is determined by the grain size of catalyst metals.") *and* (Bower at 2767) ("We found that the nanotubes grow via a "base growth" mechanism in our CVD system, and *there is a strong correlation between the catalyst metal layer thickness and the nanotube diameter.*") (emphasis added). Stated differently, catalyst size is a result-effective variable. With this teaching littering the prior art, optimizing the diameter of the resulting carbon nanotube is well within the ordinary skill in the art. *See In re Boesch*, 205 USPQ 215, 219 (CCPA 1980).

Claims 14-23, 26-33 and 35 rejected under 35 U.S.C. 103(a) as being unpatentable over US 6,878,360 to Ohsaki, et al. in view of Smalley et al.

With respect to all claims, Ohsaki appears to teach the claimed process for making carbon nanotubes with all of the various collection parts, etc. *See generally* (Ohsaki 7: 35 *et seq.*) Note discussion of catalysts and carbon sources. To the extent Ohsaki doesn't teach alcohols, this is an obvious expedient. *See* Smalley et al above. Optimizing the various flow rates is not inventive. MPEP 2144.05.

Claims 14-23, 26-33 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohsaki and Smalley as applied to claims 14-23, 26-33 and 35 above, and further in view of US 4,453,376 to Porter, et al.

The preceding discussion of Ohsaki and Smalley is expressly incorporated herein by reference. To the extent neither Ohsaki nor Smalley teach the "recycle" as claimed, this is not inventive. Porter teaches a process for making "fine carbon fibers" wherein gas is recycled. One

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would be motivated to employ a recycle loop because “[t]he recycling operation . . . makes it highly cost effective.” (Porter 3: 12-13).

Claims 14-23, 26-33 and 35 rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,102,647 to Yamada, et al. in view of Smalley et al.

With respect to all claims, Yamada appears to teach the claimed process for making carbon nanotubes with all of the various collection parts, etc. *See generally* (Yamada col. 3) Note discussion of catalysts and carbon sources. Yamada even mentions alcohol and makes note of its soot suppression, but to the extent Ohsaki somehow doesn't teach alcohols, this is an obvious expedient. *See* Smalley et al above. Note that Applicants in their specification make repeated discussion of a rotary type reactor, which appears to be what Yamada teaches. *See* (Yamada 3: 53 *et seq*) (“rotary bed”). Optimizing the various flow rates is not inventive. MPEP 2144.05.

Claims 14-23, 26-33 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada and Smalley as applied to claims 14-23, 26-33 and 35 above, and further in view of US 4,453,376 to Porter, et al.

The preceding discussion of Yamada and Smalley is expressly incorporated herein by reference. To the extent neither Yamada nor Smalley teach the "recycle" as claimed, this is not inventive. Porter teaches a process for making "fine carbon fibers" wherein gas is recycled. One would be motivated to employ a recycle loop because “[t]he recycling operation . . . makes it highly cost effective.” (Porter 3: 12-13).

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Claims 14-23, 26-33 and 35 rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,578,543 to Tennent, et al. in view of Smalley, et al.

With respect to all claims, Ohsaki appears to teach the claimed process for making carbon nanotubes with all of the various collection parts, etc. *See generally* (Tennent “Fig. 6,” 5: 45 *et seq.*) Note discussion of catalysts and carbon sources. (Tennent 6: 35 *et seq.*). To the extent Tennent doesn't teach alcohols, this is an obvious expedient. *See* Smalley et al above. Note also that Tennent appears to teach the separation and recycle. (Tennent “Fig. 6”). Optimizing the various flow rates is not inventive. MPEP 2144.05.

Claims 14-23, 26-33 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tennent and Smalley as applied to claims 14-23, 26-33 and 35 above, and further in view of US 4,453,376 to Porter, et al.

The preceding discussion of Tennent and Smalley is expressly incorporated herein by reference. To the extent neither Tennent nor Smalley teach the "recycle" as claimed, this is not inventive. Porter teaches a process for making "fine carbon fibers" wherein gas is recycled. One would be motivated to employ a recycle loop because “[t]he recycling operation . . . makes it highly cost effective.” (Porter 3: 12-13).

Claims 14-23, 26-33 and 35 rejected under 35 U.S.C. 103(a) as being unpatentable over US 6,315,977 to Cantacuzene in view of Smalley, et al.

Cantacuzene teaches a multiple stage method for making carbon nanotubes. (Cantacuzene 1: 49 *et seq.*). Recycles are taught. (Cantacuzene 4: 65). To the extent

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Cantacuzene doesn't teach the alcohol, use of the alcohol is an obvious expedient. (Smalley, et al.). Optimizing the various flow rates is not inventive. MPEP 2144.05.

Claims 14-23, 26-33 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cantacuzene and Smalley as applied to claim 14-23, 26-33 and 35 above, and further in view of US 4,453,376 to Porter, et al.

The preceding discussion of Cantacuzene and Smalley is expressly incorporated herein by reference. To the extent neither Cantacuzene nor Smalley teach the "recycle" as claimed, this is not inventive. Porter teaches a process for making "fine carbon fibers" wherein gas is recycled. One would be motivated to employ a recycle loop because "[t]he recycling operation . . . makes it highly cost effective." (Porter 3: 12-13).

Claims 14-23, 26-33 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 6,905,544 to Setoguchi, et al. in view of Smalley, et al.

Setoguchi teaches a process for making carbon nanotubes that appears to contain all of the separating/collecting parts. *See e.g.* (Setoguchi "Fig. 3"). The catalysts and hydrocarbons are taught. (Setoguchi "col. 6"). To the extent Setoguchi may not teach the alcohols, these are an obvious expedient. *See* Smalley, et al. Optimizing the various flow rates is not inventive. MPEP 2144.05.

Claims 14-23, 26-33 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Setoguchi and Smalley as applied to claims 14-23, 26-33 and 35 above, and further in view of US 4,453,376 to Porter, et al.

The preceding discussion of Setoguchi and Smalley is expressly incorporated herein by reference. To the extent neither Setoguchi nor Smalley teach the "recycle" as claimed, this is not inventive. Porter teaches a process for making "fine carbon fibers" wherein gas is recycled. One would be motivated to employ a recycle loop because "[t]he recycling operation . . . makes it highly cost effective." (Porter 3: 12-13).

Conclusion

Apparatus claims should be pursued in a divisional. The poor translation and imprecise claiming has made examination of this case exceptionally difficult and precludes a targeted search. Applicants (and their American counsel) need to understand that they are seeking to patent in a very crowded art. Nanotubes are old. Alcohols are old. Hundreds of permutations of reactors litter the prior art. Focused claiming is needed, as it is not understood what aspects of this "invention" Applicants feel are inventive. The Examiner asks Applicants to focus on this in their response and *for the fourth or fifth time now* to indicate where they are drawing support for their claimed amendments. Hopefully the 112 rejections will force the issue. It is not clear where Applicants are drawing their support. Stating where the support is may very well result in the rejection being withdrawn, so it is in Applicants best interest to do so. Many more rejections could have been crafted, but they were considered cumulative to those of record at this time.

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That said, the Examiner reserves the right to make any such rejections in the future as they become appropriate.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DANIEL C. MCCracken whose telephone number is (571)272-6537. The examiner can normally be reached on Monday through Friday, 9 AM - 6 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley S. Silverman can be reached on (571) 272-1358. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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